EYE TRACKING RESEARCH & APPLICATIONS SYMPOSIUM 2000

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Table of Contents

Welcome & Keynote Addresses

Design, Text Input, Gaze-Assisted User Interfaces

Cognition, Usability

Tracking Devices, Eye Movement Analysis

Eye Movement Analysis

Table of Contents

EFFECTIVE EYE-GAZE INPUT INTO WINDOWS™

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ABSTRACT

The Eye-gaze Response Interface Computer Aid (ERICA) is a computer system developed at the University of Virginia that tracks eye movement. To allow true integration into the Windows environment, an effective methodology for performing the full range of mouse actions and for typing with the eye needed to be constructed. With the methods described in this paper, individuals can reliably perform all actions of the mouse and the keyboard with their eye.

Keywords

Eye-gaze, disabled, mouse clicking, typing, windows.

1. INTRODUCTION

The Eye-gaze Response Interface Computer Aid (ERICA) is a computer that tracks eye movement. The system noninvasively tracks where a user is looking by monitoring the user's eye movements through a camera mounted underneath the computer monitor. ERICA was originally developed to assist the disabled by providing them with a means to communicate. The device has helped numerous disabled individuals since its inception in 1983. ERICA recently moved to the Windows platform. The mouse cursor now points to where the user is looking on the screen. To fully take advantage of the capabilities Windows has to offer, a method to click and to type with the eye needed to be incorporated into the graphical user interface (GUI).

2. GAZE CLICKING

To develop a successful "eye-mouse," the system needed to possess some means of performing mouse actions with the eye. The two obvious methods were either with a blink or by using eye fixations (calculating how long the eye dwells at a particular region).
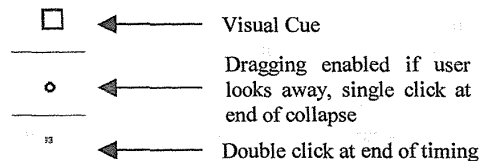
Blinking seemed like a particularly noisy methodology. Detecting a blink seemed difficult, and since people blink involuntarily every several seconds, the mechanism would have to work with a

prolonged blink. Thus, using fixations seemed more reliable.

2.1 Dwell Time Gaze Clicking

The system uses dwell time to provide the user with access to various mouse clicking actions. When the user fixates (focuses at a point on the screen and keeps the mouse cursor stationary) for a predetermined amount of time on the computer display, a red rectangle appears, centered on the point of fixation. This rectangle begins collapsing in on itself. The rectangle serves as a visual cue to the user that if they keep fixating at that point, then they will perform a mouse control action at the point. The rectangle will turn to a blue circle halfway through its collapse and then continue collapsing. If the user looks away while the blue circle is collapsing, then they will start dragging what they were fixating on. If the user prolongs their fixation and allows the circle to reach the end of its collapse, then the system clicks once on where they were looking. Lastly, a green rectangle will appear, and after a predetermined fixation time, the system will double click on where the user is fixating. Figure 1 shows the different stages of collapse.

□	←	Visual Cue
o	←	Dragging enabled if user looks away, single click at end of collapse
▬	←	Double click at end of timing

Figure 1. Gaze Clicking Collapse Stages. *The rectangle migrates through various stages of collapse to signal the mouse action it will perform.*

If the user knows they are going to be only using certain actions, like left button single clicking, then the other mouse actions may be disabled. For example, if dragging and double clicking are disabled, then the visual cue is simply a red collapsing rectangle that single clicks where the user is fixating when the rectangle reaches the end of its collapse. This is often used in children's games, where the only mouse action really needed is single clicking with the left mouse button. Also, children may have difficulty understanding the meaning of the collapse in the beginning, so disabling the multiple collapse modes facilitates teaching them to use the system.

The system may use an alternative method for clicking instead of the dwell time. If the operator still has some use of their hands,

23

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